

AVIATION WEEK

A MCGRAW-HILL PUBLICATION

NOV. 7, 1949



Designers and builders of AIRCRAFT

U. S. Air Force's New Albatross

Homeward bound, a GRUMMAN ALBATROSS salutes an older partner in the work of saving lives. Designed for rough water rescue and other operations on the open sea, this versatile amphibian carries up to nineteen persons including a crew of three. Its wingspan of eighty feet and length of sixty-one feet make it largest of the rugged GRUMMAN Amphibians.

★ ★ ★

GRUMMAN AIRCRAFT ENGINEERING CORPORATION, BETHPAGE,

Contractors To The Armed Forces

Fastener Problems

complicated by space limitations
OVERCOME WITH
ESNA SELF-LOCKING FITTINGS



—famous Red Elastic Collar... the ONLY self-locking nut principle readily adapted to specially designed aircraft fittings!

To help unaccustomed engineers overcome fastener problems complicated by space limitations, ESNA custom builds "engineered fittings" that adapt our standard types of locked assemblies by providing a single unit, complete design.

The Elastic Stop Nut shown above has been customarily engineered to meet special requirements... S-1402 for wing outer panel to wing outer section; S-1409 Exhaust/Retained threaded nut and S-1408 Transom nut for engine mounts; S-1535 flush mounting nut for engine and for floor and instrument bracket construction; S-1511 self-locking nut (single hex nuts are held by vacuum).

But there are just five of the hundreds of special Elastic Stop Nuts designed by ESNA.



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MAKES ALL TYPES AND SIZES IMMEDIATELY AVAILABLE FROM STOCK

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...for all your aircraft control needs



...cables...terminals...assemblies

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For Igniting Jet plugs in laboratory equipment

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Aviation Week

Volume 51

November 7, 1949

Number 19

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Air France's New Jet Plan...

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Aircraft Thrust on Overhaul...
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Editorial

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New Aviation Products...

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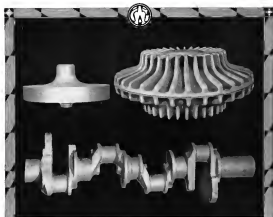
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Forgings of Aluminum, Magnesium, Steel

WORCESTER, MASSACHUSETTS, U. S. A.

HARVEY, ILLINOIS

DETROIT, MICHIGAN

NEWS DIGEST

DOMESTIC

Eastern Air Lines DC-4 on final approach to Washington, National Airport was struck by helicopter-carrying P-53 fighter and crashed, killing all 55 aboard. Pilot of the fighter, Bolivian Davalos General of Civil Aviation Eusebio Bedonko, survived and was still alive at press time. Davalos had one highest in U.S. commercial aviation history. It was the second time in recent months that an R-4E transport was hit by a military plane—in U.S. Navy fighter colliding with a DC-3 near Fort Dix, N. J., early in August, resulting in death of 16, including the fighter pilot.

Boeing Airplane Co. has gained a \$10 a share pay increase to more than \$68 related employee not approved by collective bargaining agents, and allowing a similar increase to 1200 employees who are members of the Seattle Professional Engineering Employees' Assn.

James I. Youngblood, 34, test pilot for Allison Division, General Motors Corp., died at Indianapolis from a fuel attack. He collapsed at home, after a quiet session the airport to learn a fellow test pilot, Bob Hawes, who was about to take off a jet fighter with the step down. Youngblood served with TWA, the Navy and as a test pilot at Republic Aircraft Corp. before joining Allison in 1944.

Harold C. Stuart, Toledo, Ohio, was sworn in last week as assistant secretary of the Air Force by Defense Secretary Louis Johnson. Stuart formerly was special consultant to Air Force Secretary W. Stuart Symington.

Four aircraft carriers are among the 77 Navy ships to be decommissioned during fiscal 1950. Two large cruisers, the *Knox* and *Lynn*, and three small cruisers, the *Keweenaw*, *Shenley* and *Baraka* will be "mothballed" and stored in Navy yards.

Vice Adm. Forrest Sherman was given today appointment as Chief of Naval Operations by President Truman, following removal of Adm. Louis Donnell Sherman as the first member to hold the top Navy post. His appointment is subject to Senate approval when Congress reconvenes.

Steno-Flight, Inc., Teaneck, N. J., manufacturer of aircraft, has had its operating certificate tentatively revoked for alleged safety violations. Recertification will be effective Nov. 8, unless company files exceptions. CAA suspended certificate last July following crash of a company C-46 at Fort Rucker, killing 55 of the 51 persons aboard.

FINANCIAL

Consolidated Vultee Aircraft Corp. reported a net profit of \$3,112,353 for the third quarter of its fiscal year ending Aug. 31. Profit for the last nine months of the year was \$2,970,835, compared with a net loss of \$3,596,113 for the same period last year.

United Air Lines reports a \$2,710,574 net profit for the last nine months of 1949, compared with a \$238,824 loss in the same period last year. Passenger traffic was up 11.4 percent, freight 21.9 percent and mail 21.9 percent from the 1948 period. Net profit for third quarter alone was \$2,386,715.

Cummins Aircraft Co. declared a dividend of 25 cents per share on the 160,000 shares of outstanding common stock, payable Dec. 5 to holders of record Nov. 21. This is the ninth consecutive year the company has paid a dividend.

INTERNATIONAL

An F-86F Corsair crashed on São Miguel Island in the Azores, killing all 45 persons aboard. Pilot had reported he was in the field at Santa Maria and presumably had started his takeoff for a normal approach when plane crashed into a 1000 ft peak about 45 miles north of Santa Maria. The north leg of the Santa Maria radio range intersects São Miguel at its highest peak, which has a radio beacon. Prescribed altitude over São Miguel is 1000 ft. It was Air France's first land crash on its North Atlantic run since service began in July, 1948.

Canadian Pacific Air Lines has received a foreign air carrier permit from CAA authorizing service from Canada to points in Australia and New Zealand via Honolulu, Canton Island and Fiji, with provision for optional technically stops at San Francisco.

Fokker Aircraft factories of Amsterdam, The Netherlands, have shut down their construction department and dismissed 200 employees. The reason given was that they have abandoned the idea of building three new Dutch civil aircraft.

Canada has granted a further 33-day extension of permission for U.S. trans-Atlantic carriers to use Canada (Newfoundland) Airport, pending ratification of the new U.S.-Canada air agreement which is being challenged in court by Canadian Airlines.

Wendell Wynne, 32, new British test pilot, reported Navy fighter crashed and burned at Yeovil, England, during a test flight. It was powered by Armstrong Siddeley's 4100 hp. Pyron engine and was claimed to be the world's fastest jet-propelled fighter.

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Scheduled Lines Take Coach Leadership

New transcontinental service to offer more seats than nonseats.

By Charles Adams

The scheduled certificated airlines are heading toward preeminence in the domestic air coach field in much the same manner as they captured air freight dominance from uncertificated cargo lines during 1948.

In attempting to hold on to the established business they developed, passenger-carrying certificated operators are battling on two fronts. They must meet the challenge of steadily expanding interstate services offered by the regular maillines while maintaining with Civil Aeronautics Board enforcement officials over alleged violations of federal economic regulations.

► **High Capacity Rate-During 1947 and 1948, CAB issued about 160 letters of reprimand authorizing regular flights by uncertificated means using transport-type equipment.** By Nov. 1 of this year, only 91 companies still held their operating rights.

Of these 91 airlines 25 have been cited formally by CAB for alleged 4-level activities and may lose their letters of reprimand through inaction or compliance.

American Airlines' proposed inauguration next month of daily transcontinental coach service with 70 passengers DC-4s poses a major threat to the non-scheduled carrier route. Most observers believe AA's contemplated \$110 New York-Los Angeles fare (44 cents a mile) is close enough to the regular fare (\$99-\$55 level) to make mail trouble-incomplete in view of the certificated carrier's better record of safety and dependability.

► **TWA Plans-Following American Airlines' lead, TWA has work scheduled plans for \$110 (44 cents a mile) New York-Los Angeles DC-4 coach flights starting Dec. 27, subject to CAB approval.**

TWA now operates four-embryo-airline Boeing Stearman service from New York to Chicago and DC-3 coach flights from Kansas City to Los Angeles. The TWA move placed United Air Lines under additional heavy competitive



CERTIFICATED ROUTES of all passenger carriers blanket the country, while . . .



SCHEDULED ROUTES of certificated airlines are expanding to top big population areas

pressure to establish similar coach operations.

► **18,000 Seats-If AA upholds American's estimate service, CAB will have available more than 25,000 transcontinental coach seats each week annually. The 18,000 seat capacity is only slightly less than the total number of passengers carried during all of 1948 by the four major combined airlines.**

The "Big Four" transcontinental operators last year were Viking Airlines, Bonanza, CAA, which flew 17,792

passengers, 12,292,928 revenue passenger seats; Stratford Airlines, Long Beach, Calif., 36,396 passengers and 32,716,915 Rpm; Air America, Burbank, 18,355 passengers and 26,679,000 Rpm; and Airline Transport Carriers, Inc., Burbank, 10,639 passengers and 11,607,060 Rpm.

► **Enforcement Action-Of these companies, Stratford was forced to quit service last July after CAB ordered the operator's letter of reprimand revoked for "knowing and willful" violations of**

NINETEENTWO PASSENGERS on its aircrafts as the passenger capacity of Douglas Aircraft Co.'s DC-4A left much. The same high-density seating plan, or arrangement for 14, 15, 16, 17, 18, 19 or 20

the Civil Aeronautics Act. In September, Airline Transport Carriers was ordered to stop leaving the public to believe it operates regular flights between any two points and was forbidden to make more than eight round-trips between any pair of cities during any five consecutive weeks.

Last month a CAB committee recommended that Viking's letter of reprimand be avoided for knowing and willful violations of the regulations. Charges against Viking include offering an irregularly regular service, operating after its authority had been suspended, but not in made proper reports to CAB, and failure to abide by its tariffs.

► **Voluntary Suspension-Air America is trying hard to shake off a CAB enforcement order. It voluntarily suspended flights in the first quarter of 1949 to emphasize the irregular nature of its service. It has also been ordered to keep its planes home.**

All 91 remaining "stage irregulars" have cited CAB for individual examples to require the blanket blanket operating authority which expired last June. But the carrier must show that proposed operations are in the public interest and companies with a history of illegal activity will pass that application under extreme handicaps.

► **Weakness Some-Bonanza's big cargo is operator's position is weak. If it fails to meet any two points more than twice weekly they must CAB police action for operating too frequently or irregularly. If then last factor they be one of certificated airline companies it will not only receive better but possible bankruptcy since such irregular operation is a financial shortcoming.**

Meanwhile, there is no place for the transcontinental northbound to have a competition from them all their scheduled routes. The certificated lines have already made gains through re-regulation on the New York-Miami Puerto Rico and Pacific Northwest-Alaska links.

► **PAA Schedules-Pan American Airways**

passengers, will be available in Douglas' recently-announced DC-4B, which is down-coupled and structurally identical with the DC-4A except for elimination of the heavy cargo doors, large cargo doors and other

items peculiar to a freight transport. Both the DC-4A and DC-4B are 5 ft. longer than the DC-4, have a 30,000-lb. maximum gross island weight against 27,200 for the DC-4, have slightly greater range, speed

Ratio at cruise time for more than a year. In last quarter 1948, before TAA inaugurated the coach operation, it carried 470,400 first-class passengers by more New York and San Juan. In the same 1949 quarter it carried 7797 first-class passengers plus 10,994 coach passengers between these ports.

Northern Airlines' New York-Seattle and Seattle-Anchorage, Alaska, coach flights have caused worried competition on these runs. Pan American is offering reduced winter fares to offer Alaska points and has added CAB permits to start there weekly. West Coast Airways coach service Dec. 1 with 44-passenger DC-3s. Northwest started service on the Honolulu run during the recent cold wave.

Skycoach Routes

EFFECTIVE AS OF NOV. 1

Copied Airline

New York-Pittsburgh-Adelphi, Conn.
New York-Pittsburgh-Baltimore, Tenn.
Birmingham, Ala.-Mobile, Ala.-New Orleans

New York-Pittsburgh-Chicago-Detroit-Michigan-St. Louis, Mo.
Washington-Pittsburgh-New Orleans
Los Angeles-St. Paul

New York-Panama, Canal Zone
Washington-Chicago-Detroit-Chicago

Tampa, Fla.-Wichita, Kan.-Amesbury, Minn.-St. Paul, Minn.-St. Louis, Mo.
New York-Pittsburgh-Chicago

Western

Los Angeles-Pasadena-Chicago
Portland, Ore.-Seattle

Northwest

New York-Pittsburgh-Michigan-St. Louis, Mo.-Chicago
Washington-Pittsburgh-New Orleans
Los Angeles-St. Paul

Eastern

New York-Washington-Baltimore-Washington
Los Angeles-New Orleans
New York-Miami

Pan American
New York-Los Angeles, Puerto Rico, Hawaii

Boeing

Seattle, Wash.-Portland, Ore.-San Francisco

Notated

New York-Miami

Proposed Services

Pan American

New York-Los Angeles-Puerto Rico

Delta Air Lines

Chicago-Camden-Albany-Jacksonville, Fla.-Miami (Dec. 15)

Aluminum Airlines

New York-Chicago-Los Angeles (Dec. 25)

TWA

New York-Chicago-Los Angeles (Dec. 27)

has been operating high-density DC-4s between New York and Puerto

► **Western Competition-Western Air Lines' new coach service has lowered the bar on uncertificated interstate operations in California and between Los Angeles, San Francisco, Portland and Seattle. Eastern Airlines and National Airlines planned to start coach DC-4 flights between New York and Miami this month, and Delta Air Lines hopes to begin daily mail service between Chicago and Miami with 16-passenger DC-3s on Dec. 16.**

First of the week's family lines—now offered almost universally by certificated domestic airlines—and special round-trip vacation rates have also hurt the uncertificated.

► **Limited Resources-Most airlines have extremely limited resources, and by so doing all of them have made money in the air coach business.**

Air America, which started operations in July, 1948, became one of the most outstandingly successful scheduled airlines as coach operation in its first year of service. Using Boeing DC-4s and DC-3s, the company showed a \$53,264 net profit on \$1,778,984 gross revenue during the period.

But America's assets last June 18 totaled only \$100,000. Its projected fuel cost was a few thousand dollars worth of office equipment, although payments were being made on the pas-

three of three C-60s from Siksk Air ways at a cost of \$395,000. Capital stock, outstanding came to \$1300 and paid-in surplus was \$410,000. There were 45 employees.

By acquisition, Northeast Airlines, one of the smallest domestic trunklines, had about \$4,644,000 gross revenues during 1946 and listed 190 employees early this year. Transline, Air America during its first year of operation flew about as many domestic revenue passenger miles as Colonial Airlines but only 1 percent of American Airlines until this 1946.

Continental Case—Last June, 15 new double flat increased plans to stock, test, refuel in C-47s pending insurance, rental, crewing, etc. But only about 100 are expected to be in the production when deliveries begin this month.

Mass attack is presently concentrated in litigation against the "scandal" certificate proposals will result on the argument that excessive competition will be non-revenue-generating high mail payments for scheduled routes and on the noncommercial route. The noncommercial route is not easy to run.

What Congress Did on Air Power

Appropriations increased for most agencies, research program authorized, but 70-group bill begged down.

First session of the 81st Congress left a pessimistic record in expanding military expansion and also laid the groundwork for a comprehensive program to year around at strengthening con-

American Airlines transients that long had on earth operations via its scheduled, gradually with few emergency equipment at time before first crash a mile.

An AA study shows first on hope of 1948 rules on most the security could have broken even in DC-6 operations last April at a rate of 1.7 cents a mile with April's DC-6 load factor of 69.7 percent.

Post Study—The survey is based on utilization of 52 passenger DC-6s. Since American plans to use 70 passenger DC-6s next spring to replace the leg-dreaded DC-4s which would go in coach service Dec. 17, the best-case DC-6 has theoretically could be reduced to below 1 cents a mile for one-stop coast-to-coast operations with the new 69.7 percent load factor.

American wants, however, that decrease of only 2.4 percent a plane mile from its scheduled flights would have topped out in \$3,350,000 profit in first half 1949. AA argues that in asking the committee the standard plan to give no new points but merely want to show the cost of the new business domestic lines.

Congress authorizing accomplishments on the military front were:

- **Unfinished Legislation**—The Secretary of Defense's "doctrine, authority and control" over the armed services in general, and the Department of Defense's budgetary system, was revised. It was a comprehensive, long Secretary Louis Johnson has apparently not been sought.

col aviation as a supplement to national defense.

The high level 1948 budget approved by the government aviation agencies was indicative of the congressional

intent to promote airpower. These were in each and each of the following:

- **Air Force, \$5081 Million**—This compares with \$4941 million for the 1948 fiscal year which includes 1880 million for the regular 1948 fiscal year budget and \$1215 million in the 1948 supplemental act.

- **Navy Bureau of Aeronautics, \$1618 Million**—This compares with \$1490 million for the 1948 fiscal year which includes \$468 million in the regular 1948 fiscal year budget and \$703 million in the 1948 supplemental act.

- **National Advisory Committee for Aeronautics, \$63 Million**—This compares with \$60 million for the 1948 fiscal year. NACA's 1948 fiscal year budget was only \$1.7 million, in 1946 budget, only \$12.5 million.

- **Civil Aeronautics Administration, \$286 Million**—This compares with \$149 million for the 1948 fiscal year.

- **Civil Aeronautics Board, \$12.5 Million**—This compares with \$3.4 million for the 1948 fiscal year.

- **Aircraft, \$118 Million**—Despite an audit for \$64 million, compared with \$5 million for the 1948 fiscal year. The 1949 fiscal year program annual got \$61 million, compared with \$60 million for the 1948 fiscal year.

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but more than the Navy had approved.

The Navy's Navy opposition, programs were written into the statute bearing the authority from existing changes in the combat functions assigned the services in the 1947 United States Act, prohibiting inter-service transfer of military personnel, requiring the secretary to notify Congress before making organizational changes, and explicitly authorizing the three services authorities to appeal directly to Congress.

- **Wind Tunnel Development, A \$151-million program was authorized.** This includes \$16 million for projects at NACA, Langley, \$10 million for testing and research tunnels at universities, \$6.6 million for a tunnel at the Navy's David W. Taylor Model Basin, and \$100 million for USAF's Air Engineering Development Center. \$30 million was appropriated for USAF in the closing hours of the session, to start the AEDC immediately. Its total facilities will be a hypersonic wind tunnel, a supersonic propulsion tunnel, and an altitude chamber for jet engine testing.

- **Radar Network, \$78 million** was appropriated to move forward with the \$130-million program, authorized to boost the country with an air war, say, system. A \$4.4 million radar laboratory for the National Bureau of Standards to concentrate on basic research in communications, closely related to the air warning project, was also authorized.

- **Cold War Missile Center, \$12.5 million** was appropriated to start development of a \$75 million center for long-range testing. Based in Florida, its range area

will extend up the Atlantic, with controlled explosions at Bermuda. A \$19-million laboratory for basic research in guided missiles by the Bureau of Standards was also authorized.

- **Foreign Arms Aid Program, This provided \$1.3 billion in strength, the defense establishment of non-Communist nations. It includes USAF commitments of \$86 million in Europe, \$45 million in Greece-Turkey and \$13.5 million for Iran-Pakistan-Philippines. Navy will furnish \$15 million in aircraft and parts to the European theater.**

Major rethink for military purposes was the issue of Congress to start legislation authorizing a 70-group Air Force strength. It was reportedly tangled in a House-Senate controversy when the session wound up. Both the House and Senate versions of the measure reflected a USAF strength of 34,800 planes or 225,000 aircraft pounds.

- **House Version**—The House version went further. It spelled out an earlier motion for "70 Air Force groups and 22 separate Air Force elements, represented by 31 Air Force reserve groups." It had authorization to purchase 5100 planes annually. Senate cut back on the measure, led by Sen. Vespri (California, D, R-I), asked to accept three new House provisions, dropping that the sum of an Air Force group is variable and procurement should be determined by annual procurement acts, without strong House opposition, led by Rep. Carl Vinson (D, Ga.), felt that authorization in law for a 73-group program and procurement of 5300 planes annually would be a powerful argument in their annual fight

to get implementing funds and refused to go any further in the Senate process.

The \$611 million public works bill was the only other major national defense legislation accomplished. Approved by both the House and Senate Armed Services Committees, it will probably be put through only next year.

- **Includes \$147 million in USAF projects, including \$37 million for expansion of Muroc Air Force Base and \$14 million for navigational aids and communications facilities, and \$100 million for Naval projects, including \$10 million for the Lockheed Martin Stratos and \$7.5 million for the Lae Denmark Aeronautical Laboratory.**

- **Civil Air Program**—On the contract aid assistance front, Senate Interstate and Foreign Commerce Committee ploughed laboriously and slowly forward with a comprehensive investigation of commercial aviation. Following several months of hearings, the committee staff, headed by Edward Stewart, editor of the "Journal of Air Law and Commerce," is now completing testimony.

A report by the Department of Defense specifying military requirements of commercial aviation will largely determine the course taken in Congress on the following controversial issues:

- Whether the government should finance commercial transport and steps plane development.
- Whether surplus operations should be eliminated to provide the air fleet.
- How much subsidization is warranted by national defense.



With all these budgets available, the Glenn A. Martin Co. X-291 flies off on its second test flight at Muroc, Calif., with O. E. (Pete) Tiller, chief Martin test pilot, at the controls. In addition to the three General Electric J-47 turbojets the

THREE-JET TAKE-OFF
X-291 and first X-291 test flight is scheduled on the air portion of the Douglas X-45 take-off power. Landing gear tests are shown, extended and the vehicle continues wing control for a high angle of attack during take-off. The X-291 is a 44-tonne

fight in February 1950, and had a top speed of over 500 mph. Two photographs show the aircraft in the Muroc field. The Douglas X-45 test pilot is kept up with the high-angle, high-speed attack. The X-291 is a 44-tonne



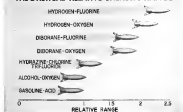
Side model of the Sikorski HO4S transport helicopter now under development for the USAF, Navy and Army shows the landing arrangement for the detachable cargo pod.

NEW TRANSPORT HELICOPTER
The four-engine helicopter has a fuselage the size of a Douglas DC-4 cabin. The HO4S is scheduled by the Pacific company for completion in 1950.

used as the Fairchild C-119 transport for intercontinental. The 48-foot X-15 is scheduled by the Pacific company for completion in 1950.

AERONAUTICAL ENGINEERING

THEORETICAL RELATIVE BALLISTIC RANGE



ROCKET FUELS are not phase of NASA's bulk propulsion laboratory studies. Mission 34 fuels were covered; those now usually used are under investigation.

New Propulsion Factors Analyzed

NACA jet, rocket research at Lewis Lab stresses design, operation details at high altitudes and speeds.

By Robert McLarven

CLEVELAND—Successful operation of turboprop, rocket, and ramjet engines at very high altitudes is receiving intense research attention at the National Advisory Committee for Aeronautics' Lewis Flight Propulsion Laboratory here. At present problems being comprehensively investigated include development of improved fuels, component design, cooling, and new materials.

Serious investigations of turbojet aircraft fuels and operations at altitudes from 50,000 to 70,000 ft are now fully developed. These investigations embrace flight speeds from high subsonic to 2½ times the speed of sound. Alvin Silverstein, newly named Director of Research of the Laboratory, states unequivocally that the United States now "knows more" about propulsion problems in these regions than any other nation in the world.

■ **High-Altitude Problems**—Four principal problems of the turbojet engine at high altitude have been studied: a NASA's Lewis Flight Propulsion Laboratory *Acoustics, ignition, blow out, and combustion*. The problem of acousticing a turbojet engine at 70,000 ft., for example, is created by a combination of two factors:

* Purities reported for acetylation: reagents the same; expenditure of aldehyde since this is determined by the moles of the solvent used.

• Power available for ventilation at 50,000 ft is only about one-sixth that at sea level since the power of a turbulent regime varies approximately as the density of the ambient air. If a constant throttle setting is maintained, fuel/air ratio of the mixture in the combustion chamber increases with altitude. At high altitude a rich mixture is being supplied the combustion and as a consequence the throttle for ventilation, supplying additional fuel, simply quenches the flame and no combustion results.

► **Varying Tail Pipe Back-Pressure**—One solution to this high-altitude acceleration problem is the use of a variable area exhaust nozzle. At a given throttle setting and altitude, speed of the turbine is determined by the amount

back pressure in the tailpipe. If the area of the exhaust nozzle can be increased as is the case with a variable-area nozzle, back pressure is reduced and the turbine is accelerated. Turb indicates that the turbine of a typical turbojet engine can be accelerated with an open nozzle in just one-half the time of the same engine with variable nozzle in the closed position.

position (leaving tailpipe about 4 ft from back):

Vernalis-Fall Nuclei:The cold air (-67°F day, 10°F under standard conditions) of high altitude lower had temperature and so increases the viscosity that it cannot be sheared in the case heavily through a fixed-size control spray nozzle. Solution to this problem is the NACA variable-area fall nozzle, which is automatically adjusted by variations in air velocity. This nozzle provides a fine, fully-aerated jet spray at all altitudes due to its unique characteristics of providing a constant low pressure regardless of the ambient atmospheric pressure.

The so-called "hot start" (boots as the ground and so the air) is caused by a flooding of the combustor with new fuel. When ignition takes place the fuel explodes rather than burns, the temperature of the turbine inlet flow rises rapidly and part damage can be done in a few seconds. The variable-area fuel nozzle also solves this problem by preventing the escape of large fuel droplets into the combustor.

To start an Allison F43, for example, the pilot pushes the throttle forward and, as the turbine temperature begins to mount rapidly, he pushes the throttle forward in an attempt to prevent overloading the 1450 deg. F normal starting temperature. The careful mismanagement of throttle during starting comprises one of the major training problems for jet pilots. The NACA engineers fear that a novice would make this unnecessary because it permits the temperature to climb to 1450 deg. F and hold steady there.

Another cause of "hot starts" is the fact that only two spark plugs are fired throughout the combustion cycle, most of the other combustion being accomplished by cross-flow tubes, which are mounted on each of the combustors. NASA's report has indicated that the tubes used on current designs are too small in diameter and an increase in their size provides much greater reliability in operation.

• **Spaciness at High Altitude**—An important study of the altitude spaciness problem was an examination of the spaciness scores, measurements of high altitude

The spark energy required for combustion of a typical turbulent engine actually doubled when altitude was increased from 31,000 to 50,000 ft. Grantly increased volume of air flow, associated reduced fuel flow (only 1/30th that of sea level) and greatly reduced pressure made much heavier demands on the electrical system than present equipment supplies. However, this increased

gation also indicated that working less long is as bad as working reducing increasing spark energy requirements. The lowest spark energy required, as a typical jet engine, lies in a fuel-air ratio of 0.05/0.09 (11 to 12) parts per 100 part fuel, with the requirement increasing as the ratio increases to 0.12 or decreases to 0.06.

The Lewis Laboratory incorporated all of these improvements in a typical turbojet engine and found that its specific altitude was increased 50 percent. These changes can be made in any existing turbojet engine since they do not require extensive design changes. By simply moving the electrode into the center of the fuel spray, increasing the amount of electrical energy supplied and utilizing longer crown jet fuel, this 50 percent improvement in specific altitude can be obtained.

► **Rocket Motor Ignition**—Increasing Air Force interest in the use of auxiliary rocket motors which are fired at high altitude for quick acceleration of fighter aircraft has also focused attention on the altitude ignition of rocket fuels. This problem is in some respects similar to that of the turbojet engine in that low temperatures at high altitudes chill the fuel and impede its flow.

At sea level propane starts at a rocket motor is usually obtained when the fuel temperature is above -10 deg F. At lower temperatures at sea level, the motor will not start. Above 50,000 ft., this critical temperature is lowered to -20 deg F. At this altitude, at temperatures between -20 and 5.5 deg F, no explosion can result when a start is attempted.

When the "hot" button is pushed, fuel flow begins and no ignition spark is released. At sea level, ignition usually occurs 0.015 sec. after sparking, but at 50 000 ft. ignition is delayed to 0.0413 sec. This small delay is long enough to permit the highly volatile fuel to accumulate in the chamber and cause a violent explosion when ignition occurs. Two solutions are being examined.

(11) the use of various product feed add:
 (12) and (13) feed handling.

High Fuel Performance—The type of fuel used in the turbopump has an important bearing on the engine. Extensive evaluation of the new JP-1 jet engine fuel provided an added impetus over conventional JP-1, including an ability to start at an altitude 75 percent higher than JP-1 in a typical turbopump. This ability to burn at temperatures as low as -80 deg F in atmospheric conditions, performing at 60,000 ft, makes the engine starting capabilities. How

fact, this characteristic is masked at somewhat reduced flameability limits at low load. JFJ will burn at low load only, between temperatures of -80 deg.

PRODUCTS FROM CRUDE OIL



AVAILABILITY of new 100-yr lead is shown at 50 percent of level of each. Supply of lumber alone would be insufficient to anticipate for large number of craft.

F, and 15 deg. F. IP1 has sea level
 homogeneity limits of 100 deg. F. to
 170 deg. F.

Development of a "cut IP" is recommended by NACA researchers on the basis of tests of ordinary IP's in which the light ends have been cut off and the more volatile components removed. This fact has lowered flammability limits of 10 deg. F. to 100 deg. F. and burns at a 60,000 ft. altitude (tropopause) but as low as -40 deg. F., which is not low enough to permit operation at this altitude. This diminishes the feasibility of hydrocarbon fuels as well as shift of its no-level flammability limits is accompanied by a similar shift in its low-velocity limits.

Yippee also is not in tension with jet fuel as with gasoline-type fuels, which lose about 8 percent by volume in a climb from sea level to 40,000 ft. However, jet fuels (represented by JP-8) are susceptible to "slopping", a phenomenon in which the fuels bubble violently, quiet down, then suddenly bubble too loudly again. At 20,000 ft JP-8 begins to boil, at 30,000 ft it surges, and at 40,000 ft little wisps of its original volume. This problem is being attacked separately by Army Laboratory studies.

► **Food Supply Problems**—Proving the chicken or the egg had a complicated supply problem. Avocado produce is plentiful but it is not highly valued for the relatively simple processing of marketing. Kiwano is ideal but is available in such small quantities that normal processing and marketing procedures are to be a natural story.

A single barrel of waste oil is refined to produce about 40 percent gasoline, 6 percent kerosene, 17 percent diesel oil, 24 percent bunker fuel, 3 percent

lubricants and 10 percent other petroleum products. By combining the refining of gasoline, kerosene and diesel into a single feed, one barrel of crude oil can be used to produce 30 percent JP-3 fuel, which would provide an ample supply even in a worst-case

The presence of aromatics in fuel permits an increase in supply through a distillation of the refining process. NAGCA has investigated the effect of various degrees of aromatic content on jet fuel properties. Normal aviation gasoline, which contains about 6 percent aromatics has a boiling range of 100-150 deg. F. JP1 jet fuel, with about 15 percent aromatics, has a boiling range of 125-140 deg. F. JP-3 jet fuel was found to be totally unsuitable to be used as fuel of aircraft. Two samples containing 15 percent and 20 percent aromatics both displaying a boiling range of 160-500 deg. F.

The presence of aromatics, of course, produces a carbon deposit which is harmful to engine operation. Armon produces the least amount of carbon deposits in turbojet engines, and JP-5 containing 20 percent aromatics the highest, indicating the penalty paid for this refining advantage. However, tests indicate that JP-5 containing 10 percent aromatics produces carbon deposits less than that of JP-1 containing 15 percent aromatics, so

• **Rocket Fuel**—NACA has made significant advances in evaluation of rocket fuels. One fact, *(Chemical Engineers)*, pointed a temperature of 6800 deg. F., believed to be the highest temperature ever recorded in the United States. Results of this evaluation program are summed up in a comparison of the

different fuels encountered on the basis of the range they would produce in a given engine.

This analysis was qualitative and as a base with a large value of 100 percent alcohol-oxygen produced a range of 1.01 times that of gasoline-oil, hydrogen-chlorine trifluoride a range of 1.81, diborane-oxygen 1.93, diborane-fluorine 1.96, hydrogen-oxygen 2.29 and hydrogen-borane 2.45 (times the range of gasoline-oil). For the first time a rocket fuel has been mentioned publicly having a greater specific impulse than liquid oxygen liquid hydrogen, long considered the greatest theoretical heat energy releasing chemical combination.

Due to the extremely difficult and dangerous handling qualities of hydrogen-oxygen and hydrogen-borane rocket fuels, NACA has not yet actually tested these two fuels and flame gases values are theoretical. Extensive trial work now has been made of all the others in the group and their characteristics are known.

► **Rocket Chamber Cooling.** One of the problems of rocket chamber cooling interest is shifting from the familiar regenerative system in which the fuel flows through a direct intercooling the chamber prior to entering the main chamber, in film cooling, in the inter-cool and oxy-fuel flow into the chamber through porous walls to form a liquid layer that conducts heat away from the few within the chamber. Criteria for analysis of this system is the length of film coating along the duct. Research data indicate that the length of cooled duct deactivation of the coolant increases in inverse relation to the coolant velocity, but decreases as gas velocity along the duct increases and as the percentage of the gas made the duct increases.

Another rocket chamber phenomenon under investigation is "chugging," a fluctuation in fuel flow in which the flame actually cuts out into the rocket chamber and then starts back over a long hot line of fuel at a constant frequency of about 30 cycles per second. "Chugging" is known to be a destructive phenomenon since it causes vibration within the rocket that has resulted in the rupture of fuel lines and tanks.

► **Turbopump Materials.** NACA has a major research program aimed at the reduction of critical materials used in the turbopump. Chromium, nickel, cobalt-nickel, and tungsten carbide, and tungsten carbide in various forms are heat-treated in air, hydrogen, or other materials from the point of view of single property in the event of a material emergency. The history and

use of each of these materials is discussed by 10 percent of the total critical materials being used in a typical turbopump in the turbine blades, which

comprises only 2 percent of the total engine weight; 20 percent of the critical materials in the turbine disk, (15 percent of engine weight), and the remaining 78 percent critical materials in combustion engines, compressors, etc.

► **Shocking Aircraft.** The research approach to the problem is threefold:

- Provide suitable non-critical materials.
- Develop more accurate design methods to permit weight reduction and reduce critical material content.
- Reduce operating temperatures, which necessitate use of critical materials, by turbine cooling. The Lewis Laboratory interest in materials and atmospheric chemistry continues to produce over more promising heat-resistant materials. One of the hints of these is molybdenum disulfide, an interestingly chemical combination produced by powder metallurgy.

Titanium nitride and silicon nitride are the best of the ceramics. Bore ceramic and iron, a new ceramic, at through section to the turbine crown at temperatures up to 2500 deg., may be very effective at extremely high temperatures in the 5-5000 deg. range. These two ceramics, while highly resistant to temperatures, show a strength only matched stress of molybdenum disulfide, currently the most promising high temperature material under events.

Major attributes of the new material is an extremely high resistance to oxidation, a failure of most heat-resistant materials. Molybdenum disulfide also has good resistance to thermal shock and low low density, reported in the blading material used in the characteristic of the material.

Substantial weight reductions have already been made in turbine disks using improved design methods permitting a disk to have a constant safety factor along a radius. Previously, variations in stresses and strength of turbine disks from hub to rim resulted in excessive weight. It is now possible to design a turbine disk in which stress varies directly with temperature at any point in the disk.

Much of the excess weight of turbine disks has been devoted to mixing stress resistance, because of a lack of knowledge of vibratory stress and modes in the disk. Low-frequency stresses are fairly easily analyzed but higher order modes have been difficult to predict. NACA solved this problem, producing laminated powder in motion on a horizontally-mounted disk supported at the hub. As vibration is introduced into the disk, the powder is ejected into troughs of the mode resulting in an accurate image of laminated powder being forced in the disk surface, showing clearly the amplitude and frequency of the motion.

► **Engine Blade Vibration.** Studies show that hollow blades (now coming into prominence) have twice as many modes of vibration in solid blades. Critical is the "bending mode" in which the two halves of the blade move relative to each other. This is an extremely serious but inherent consequence of an aerodynamic blade divided along its mean line, since the input surface must be longer than the lower surface. NACA discovered that mounting a series of vertical stiffeners (with respect to the chord line of the blade) prevented the cooling passage of the blades, yet produced the same vibration mode as found in a solid blade.

Several solutions to the problem of blade vibration have been investigated, including the use of blade dampers, an extremely complex method, and the use of mechanical damping obtained by fitting the blades loosely in their sockets. Experimental tests of the latter method revealed that centrifugal forces of high rotor speeds effectively tightened the blades in their sockets. Use of a lubricant in the socket effectively lowered vibratory stresses in the blades. Typical example of one material suitable for use in the last method was there in the problem of loading suitable lubricants capable of withstanding the high temperatures common to gas turbine runs.

Yet another example is contained in the solution to the problem of "bent-up mode" of hollow blades, corrected by the use of natural stiffness. This theory brought in the problem of temperature differences between the coolant flows in the same blade passage creating thermal stresses within the blade.

Examination of this problem makes use of a unique method proposed by M. A. Reed, well known mathematician. A large scale model of the blade is cut from ordinary Lucite and a "deflection star" mounted on its edge. This is simply a small device with a variety of thin strips which extend from local stresses into the Lucite model. When viewed through a polarizing filter, increased light shows stresses are revealed in much colored lines, their intensity being a direct indicator of the degree of the local stress.

► **Turbine Cooling.** Little has been done for higher operating temperatures in gas turbine engines continues unabated, since turbine efficiency and power vary almost directly with operating temperature.

Further cooling now appears the most promising method of attaining operating temperatures in the 2500 deg. F. range. In a graphic demonstration of the revolutionary effectiveness of turbine blade cooling, a solid blade in a hollow, insulated duct, a fixed, air-cooled blade, and a water-cooled blade

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was mounted in a duct and subjected to an 800 deg. F. gas flow.

All blades went through up to about 750 deg. F. and their respective cooling methods termed as "quality," the best low-temperature blade dropped to 650 deg. F., the forced-cooled blade dropped to 550 deg. F., and the water-cooled blade dropped to only 330 deg. F., well under one-half that of the initial block. Although obviously the water-cooled blade system is vastly superior, it would require a water supply, a radiator and extensive piping. Therefore the forced-air-cooled blade system is receiving the greatest attention at the present time.

Airside analysis of turbine blade cooling depends largely on development of accurate and simple heat transfer analysis methods. The straight-line relationship between Nusselt Number (a heat transfer factor) and Reynolds Number (a flow factor) was experimentally determined using conventionally low-temperature gas flows. The Lewis Lab workers found that high temperatures (up to 2100 deg. F.), although permitting this straight-line relationship, produced a family of curves, one for each temperature, which destroyed much of the usefulness of the parameter. Such a curve actually underestimates cooling requirements of high-temperature gas flows by as much as 21 percent.

NACA researchers revealed that the most important region in which temperature was vital was next to the wall of the duct. Measurements taken at this point, together with the accompanying measurements of the Rayleigh Number (a factor), brought this family of curves together upon a common straight line and thus produced a simple and widely-useful (theoretically verified for velocities of flow between 10,000 to 100,000 ft./min.)

But this method reveals that pressure drop through the duct increases with the amount of heat transferred, thus creating another vital problem in the use of turbine cooling. Its adverse effect on engine performance.

► **Rampet Propulsion-Superior:** aircraft propulsion problems now center largely on the major engine troublemaker high fuel consumption of the rocket motor is useful only for extremely short duration, high velocity flight. The high thrust efficiency of power required with flight velocity is accommodated, fortunately, by a similar variation in power from a ram-compression engine.

The amount of the ram compression theoretically varies directly with speed, but the practical problem of retaining that compression is unsolved.

The tunnel shock wave formed across the inlet at a simple jet engine into the stream of mass energy. One solution is the "tunnel body" type of supersonic

inlet, first proposed by Grintschik in Germany. Here a curved cone bends the strong normal shock up into a series of oblique shocks at the tip and a weak normal shock at the tip of the diffuser.

Both types, however, are accurate to "off-design" operation. If the amount of flow at faster than design speed, the shock wave is "weakened" and the amount of ram compression seriously reduced.

And if the aircraft is flown slower than design speed, shock waves ahead of the inlet and compression is again reduced, although not so seriously. A similar result is obtained when the engine outlet is made too large, causing the normal shock wave to be "weakened" and ram compression lost. Still another effect deleterious to ram compression is pollution in combustion, which creates a back-pressure in the inlet causing the shock wave to move ahead of the inlet.

► **Rampet Inlets:** Placement of ram-compression problem of supersonic aircraft design was revealed by the first research project conducted in the new 8 ft. x 6 ft. engine tunnel, in a ram-compression inlet about three months. Tests of a body of revolution, simulating a swept-winged fuselage, revealed that 66 percent of the available ram compression was lost at the rear of the body at one angle-of-attack. When the model was mounted at 6 deg. angle of attack, it was noted that total throat area was located at the bottom of the airbody but little ram was used able in five large areas on the top of the body.

Thus this investigation of optimum location of ram compression inlet on a body indicated that the lower all positions would be suitable for a swept-on gas jet inlet.

Other tests have isolated the fact that, since swept-winged supersonic aircraft may use the active fuselage for an engine, the aerodynamic design of the fuselage and the engine compressor inlet design problem and aerodynamic and powerplants can no longer be isolated as contributing separate design problems.

Thus it is able to use a ram-compression engine in the net thrust obtained after subtracting the nozzle drag from total thrust. Thus, the nozzle drag has a direct bearing on the amount of thrust available for propulsion of an aircraft. This nozzle drag has an even more direct bearing in that it determines characteristics on the inlet, the amount of ram compression through flow changes at the inlet. Conversely, engine operation has a profound effect on nozzle drag, and supersonic wind tunnel tests have established that nozzle drag varies directly with the faster air being used by the engine.

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Seen in the drawing above the side the new Martin XB-51 is the latest of the Air Force's postwar jet aircraft. Powered by three turbo jet engines, the XB-51 is a revolutionary high speed bomber designed specifically for the destruction of ground targets. Like other postwar jet aircraft, the XB-51 is equipped with Whittaker aircraft valves. Whittaker 500 inch water-operated hot air valves control the engine bleed of the jet engine component in distribution system.

Whittaker 500 inch water-operated Hot Air Valve



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gray cleaner, more uniform holes. Part of a C-54 modification required by Air Force industrial order, the half holes are cut out of the slurring rolls to allow more for a vacuum hole. The rig devised for cutting this groove can mill a steel plate and finish which is quickly attached with locating pins to provide a two point guide for the drill.

The drill rig eliminates handwork and shortens seriously the expensive set-up time which would be required to perform the operation on a mill. Another major feature, requiring less than four hours to build, has revised tooling and holdup time on cylinders by 50 percent to TEMCO's hydraulic shop.

Designed to handle some gas engine cylinders and two types of C-54 wing flap cylinders as the C-54, the fixture consists of three basic parts—a baffle attached permanently to the block, a pin and bracket assembly for holding the fitting at the end of the cylinder and a leather-padded clamp to grip the cylinder.

Pin and bracket assembly is attached to the baffle with two large set screws, so that it can quickly be moved to any of three positions to accommodate the three different length cylinders the fixture is designed to handle.

Also, the fitting has eliminated the danger of scoring the cylinders, which was always present when they were clamped in a vise.

A similar fixture has been devised for C-54 main gear cylinders, and others are being developed to handle the hydraulic component on F-47, F-6, F-15 and other aircraft. The company is strengthening for foreign governments.

Protects Carburetors

A new pecking and flushing procedure for carburetors, which reportedly permits faster removal, reduces danger of explosion and prevents carburetor discharge breakage, has been developed at the Ford-Holston Air Force Base, Calif.

Involving the use of soap suds, the system was developed by R. C. Poppe, civilian engineer at the base, where it became apparent that the old method of pecking (killing with oil for thought) and flushing (cleaning with petrol) was unsatisfactory because unabsorbed delivery grommets in the carburetor chambers broke too many diaphragms, each costing about \$10.

Under the new arrangement, procedure of use carried experimental to the voltages' back, eliminating the explosion hazard. A pump, with regulated air pressure, distributes the fuel oil to both sides of the diaphragm at equal pressure, neutralizing any static in the jet.

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17 in. of shaft to suit the engine. This unit handles maximum available torque 24,000 lb-in. Weight, 17 lb. (See also actuator with 100 lb-in. torque, 17 lb.)



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Designed to handle the torque of the engine. This unit handles maximum available torque 24,000 lb-in. Weight, 17 lb. (See also actuator with 100 lb-in. torque, 17 lb.)



**STARTER MOTOR
FOR JET TURBINE**
Equipped with clutch and brake. Satisfies most design demands in respect to torque requirements.



EXPLOSION-PROOF ALLISON ENGINE MOTOR
Designed to handle the torque of the engine. This unit handles maximum available torque 24,000 lb-in. Weight, 17 lb. (See also actuator with 100 lb-in. torque, 17 lb.)



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Unit has highly sensitive, electro-mechanical balance for control of electronic circuit. By feeding output back to input for continuous comparison, error caused by variations in low voltage, ambient temperature, tube characteristics, etc., are said to be virtually eliminated. Device is shock resistant and all moving parts are mechanically sealed.

Measures Current

"Ratometer" Man Amp current transformer, offered by Industrial Devices, Inc., Telford, N. J., used for the detection of current. Instead of current-carrying wire is merely slipped through opening in case of rail.

Disregard Model 818, device measures d.c. with positive and negative light. Pointer is located inside light enclosure, at which position, current can be read in amperes directly off dial. Ammeter is designed for reading 100, 200, 400, 800, 1,600, 3,200, 6,400, 12,800, 25,600, 51,200, 102,400, 204,800, 409,600, 819,200, 1,638,400, 3,276,800, 6,553,600, 13,107,200, 26,214,400, 52,428,800, 104,857,600, 209,715,200, 419,430,400, 838,860,800, 1,677,721,600, 3,355,443,200, 6,710,886,400, 13,421,772,800, 26,843,545,600, 53,687,091,200, 107,374,182,400, 214,748,364,800, 429,496,729,600, 858,993,459,200, 1,717,986,918,400, 3,435,973,836,800, 6,871,947,673,600, 13,743,895,347,200, 27,487,790,694,400, 54,975,581,388,800, 109,951,162,777,600, 219,902,325,555,200, 439,804,651,110,400, 879,609,302,220,800, 1,759,218,604,451,200, 3,518,437,208,902,400, 7,036,874,417,804,800, 14,073,748,835,609,600, 28,147,497,671,219,200, 56,294,995,342,438,400, 112,589,990,684,876,800, 225,179,981,369,753,600, 450,359,962,739,507,200, 900,719,925,479,014,400, 1,801,439,850,958,028,800, 3,602,879,701,916,057,600, 7,205,759,403,832,115,200, 14,411,518,807,664,224,000, 28,823,037,615,328,448,000, 57,646,075,230,656,896,000, 115,292,150,461,313,792,000, 230,584,300,922,627,584,000, 461,168,601,845,255,168,000, 922,337,203,690,510,336,000, 1,844,674,407,381,020,672,000, 3,689,348,814,762,041,344,000, 7,378,697,629,524,082,688,000, 14,757,395,259,048,165,376,000, 29,514,790,518,096,330,752,000, 59,029,581,036,192,661,504,000, 118,059,162,072,385,323,008,000, 236,118,324,144,770,646,016,000, 472,236,648,289,541,292,032,000, 944,473,296,579,082,584,064,000, 1,888,946,593,158,165,168,112,000, 3,777,893,186,316,330,336,224,000, 7,555,786,372,632,660,672,448,000, 15,111,572,745,265,321,344,896,000, 30,223,145,490,530,642,689,792,000, 60,446,290,981,061,285,379,584,000, 120,892,581,962,122,570,758,768,000, 241,785,163,924,245,141,517,536,000, 483,570,327,848,490,283,035,072,000, 967,140,655,696,980,566,070,144,000, 1,934,281,311,393,961,132,140,288,000, 3,868,562,622,787,922,264,280,576,000, 7,737,125,245,575,844,528,561,152,000, 15,474,250,491,151,688,857,122,304,000, 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259,614,841,605,624,280,218,666,667,200, 519,229,683,211,248,560,437,333,333,400, 1,038,459,366,422,497,120,874,666,666,800, 2,076,918,732,844,994,241,749,333,333,600, 4,153,837,465,689,988,483,498,666,666,800, 8,307,674,931,379,976,966,997,333,333,600, 16,615,349,862,759,953,933,994,666,666,800, 33,230,699,725,519,907,867,989,333,333,600, 66,461,399,451,039,815,735,978,666,666,800, 132,922,798,902,079,631,471,957,333,333,600, 265,845,597,804,159,262,943,914,666,666,800, 531,691,195,608,318,525,887,829,333,333,600, 1,063,382,391,216,637,051,775,658,666,666,800, 2,126,764,782,433,274,103,551,317,333,333,600, 4,253,529,564,866,548,207,102,635,666,666,800, 8,507,059,129,733,096,415,255,271,333,333,600, 17,014,118,259,466,181,030,510,542,666,666,800, 34,028,236,518,932,362,061,021,085,333,333,600, 68,056,473,037,864,724,122,140,210,666,666,800, 136,112,946,075,729,448,244,280,421,333,333,600, 272,225,891,451,458,896,488,562,842,666,666,800, 544,451,702,912,917,717,775,125,525,666,666,800, 1,088,903,405,825,435,435,551,251,051,333,333,600, 2,177,806,811,650,870,871,102,502,102,666,666,800, 4,355,613,623,301,741,742,205,005,205,333,333,600, 8,711,227,246,603,483,484,410,010,410,666,666,800, 17,422,454,493,206,966,968,820,020,020,666,666,800, 34,844,908,986,413,933,837,640,040,040,333,333,600, 69,689,817,972,827,867,675,280,080,080,666,666,800, 139,379,635,945,655,735,350,560,160,160,333,333,600, 278,759,271,891,311,471,701,120,320,320,666,666,800, 557,518,543,782,622,943,402,240,640,640,333,333,600, 1,115,037,087,565,245,886,804,480,128,128,666,666,800, 2,230,074,175,130,491,773,608,960,256,256,333,333,600, 4,460,148,350,260,983,547,217,920,512,512,666,666,800, 8,920,296,700,521,967,094,435,840,102,102,333,333,600, 17,840,593,401,043,934,871,680,204,204,666,666,800, 35,681,186,802,087,869,743,360,408,408,333,333,600, 71,362,373,604,175,739,486,720,816,816,666,666,800, 142,724,747,208,351,479,973,440,163,163,333,333,600, 285,449,494,416,703,959,946,880,326,326,666,666,800, 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PRODUCTION



SPRAWLING Midville, N. J., factory here was converted by Airwork into a factory type...



PRODUCTION LINE engine-overhaul plant slated to be the heart of the East Coast

Airwork Thrives On Overhauls

East Coast firm stakes its future on handling plane engines exclusively on a production-line basis.

By Scott Brimager

In the three years since it secured a CAA shop certificate, Airwork Corp. has consolidated into the busiest aircraft engine overhaul firm on the East Coast. Located at Midville, N. J., a World War II fighter base, with plenty of room to expand, Airwork already holds exclusive contracts to overhaul all Pratt & Whitney engines for three scheduled airlines—Columbia, Trans World Air Lines International and All America—and is the standard P&W overhaul shop for several scheduled carriers. The firm also has contracts with foreign govern-

ments through ECA, in addition to the 15 projects of its business center from cooperation with airlines.

Overhauling "plus pricing," for most of 1947, Airwork, so far, has not been rated under overhauls on about 2000 single and double-engine P&W engines, ranging from the R-955 to the R-2800. This does not include top overhauls, or the growing engine recovery overhaul business being carried out separately for the Navy, Civil Aeronautics Administration and Civil Aeronautics Board. The firm takes care of work at the engine on CAA and CAB planes operating on the East Coast.

► **Engine Line Expands**—While it has expanded only in P&W, powerplant work, up to now, Airwork is setting up a new production line to take in Continental 1795, Pratt & Whitney, president of the firm, estimates that engines power about 1200 Beech Bonanzas and Ryan Navajos located out of the Mississippi. He says engines from corners of these craft are "increasing" since the company announced the new service.

The firm expects its major overhaul production rate of 40 engines and several hundred accessories per month to drop considerably when the Continental 1795 line becomes active.

Airwork also opened a branch office at Nassau International Airport last month to handle its expanded spare parts business, and is presently dedicating to empty engines on a flight-hour rental basis to several scheduled airlines. It is claimed that this plan would cut down initial capital investment in new operation and give firms a chance to get on their feet. Some employees, however, that this arrangement will be chiefly successful.

With a total floor area of 90,000 sq. ft., half of this a shop space—Airwork says it is prepared to handle 125 double- and 50 single-engine engines, and around 1000 accessories and other accessories monthly. Its two test blocks can mount anything from the 185 to Pratt & Whitney's largest piston engine, the R-4100 Wing Major.

► **Sticking to Engines**—Airwork is sticking its future on being a "master in the field" of engine overhauling. Here and in no other industry that is specializing only in engines on a production-line basis, they can turn out the highest quality work at the lowest price.

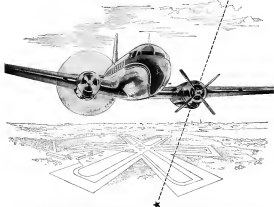
This philosophy usually is paying off. The company was the last permitted by Pratt & Whitney to grant knock-out pin holes on the critical gasket rail of its engine. Before this, P&W had insisted that job be done at its factory. The firm also awards numerous other jobs. For example, it is equipped to line bore a power crankshaft to assure alignment of the main bearing surfaces. Thomas Dekker, Jr., vice president in charge of operations, points out as evidence of Airwork's high overhaul standards the CAA decision to extend clearance operating time on TWA International's R-2800 engines from 500 to 1200 hr.

► **Money Saves**—The company also has found several other ways to save its own and its customer's money. It keeps overhaul prices and operating expenses down by:

- Avoiding engine types which will not react to the company in sufficient volume to warrant setting up a production line.
- Avoiding expensive production line

Flight Stability

Unimpaired by This*



SINGLE ENGINE PERFORMANCE

Service Ceiling: Max. Continuous Power, Weight 10,607 lbs., 23,110 ft.
(R) or 23,200 ft. (J) (J) (J)

Rate of Climb: Max. Continuous Power, Weight 11,247 lbs.

Sea Level, 10,607 lbs., 23,110 ft. (J) (J) (J) 210 ft./min.
5,000 ft. Altitude, 10,607 lbs., 23,110 ft. (J) (J) 210 ft./min.

Max. Range: Length, required by CAA

Takeoff, Sea Level, Weight 10,607 lbs., 23,110 ft. (J) (J) 210 ft./min.
Landing, Sea Level, Weight 10,607 lbs., 23,110 ft. (J) (J) 210 ft./min.

Even if one engine becomes inoperative, the Scandia's stability and maneuverability remain unimpaired. In fact the plane's single engine performance puts it in a class by itself. All pilots who have flown the Scandia are unanimous in praise of its remarkable flight characteristics.

Scandia

SVENSKA AEROPLAN AKTIEBOLAGET • SAAB AIRCRAFT COMPANY • SWEDEN

SALES & SERVICE



RYAN NAVION has been equipped with a rocket booster to demonstrate a new way to make the plane more useful. Here a re-engineered Navion and a new plane take off together to show how better . . .



CLIMBS FAST In 191 ft. A climb . . .



OVER TREES In another demonstration of the recent utility added in new form, a Navion is shown . . .

How JATO Cuts Navion Takeoff

Boat Accessories Co. and Aircraft Engineering Corp. have tested out a JATO installation for the Navion which points to future commercial and military use for takeoffs over obstructions from sea, high-altitude fields.

The JATO booster unit weighs only 16 lb., and is 10 in. in diameter and 25 in. long, but it gives 210 lb. thrust for 12 sec. Its principal use is seen for training and construction companies in remote areas.

The small size rocket booster probably won't be available commercially for at least another year, although the unit has been awarded CAA rocket type certificate No. 230. So far, tests of the installation have been confined to Army Field Proving Grounds (which has a number of Navions for lease and personal use part use) and experiments by the manufacturer.

Aircraft Corp. can't offer the JATO booster commercially until security restrictions are lifted. Power-Ryan reports that the Navion, which usually climbs over a 50 ft. obstacle in 875 ft., can clear the same obstruction in only 350 ft. with the rocket booster. This is attached to a single firing underneath the fuselage. A Navy steel clamp encloses the solid fuel propellant unit. The JATO's thrust augments the conventional Navion powerplant, a Continental engine rated at 185 hp. (in takeoff).

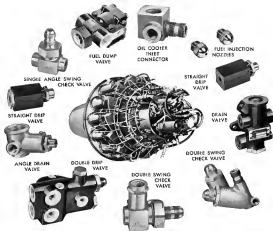
In the comparison test shown here, the rocket-assisted plane had reached an altitude of 154 ft. when 500 ft. from the takeoff. The other plane was just getting off the runway about 500 ft. from the starting point. Both planes started simultaneously.

Small unit has one-fourth the thrust of the engine. JATO unit which has been widely used for several months at military bases of many types.

A 6 volt electrical spark starts the rocket motor. Operating chamber pressure while the propellant material is burning rises from 510 psi to 1650 psi.



WITH JATO giving 210 lb. of thrust for 12 sec.



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THE vital importance of ultimate "jet" performance calls for the finest precision workmanship. The requirement is fully met by Kohler, and all leading manufacturers of jet engines value extensive use of Kohler drain valves, single swing check valves, double swing check valves, standard AN approved 1500 PSI and 3000 PSI check valves, fuel injection needles, dump valves, drip valves, metering valves, AN fittings, special sandcast and forged fittings, and

many other Kohler-made special precision parts. Complete facilities in our plant at Kohler, Wisconsin, to forge, sandcast, tool, machine, finish, assemble, test, inspect and ship quality controlled parts when required, make Kohler Co. a leading manufacturer in the precision parts field. Kohler engineers will gladly cooperate in developing special parts for individual requirements. Send for our new catalog. Kohler Co., Dept. E-K, Kohler, Wisconsin.

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AIR TRANSPORT



BELL FEEDERLINER, one of three new entries in the commercial helicopter field.

Transport Helicopters Revealed

Outlook brightens for the start of scheduled cargo passenger operations with disclosures on big craft.

By Stanley L. Colbert

Three manufacturers of military transport helicopters last week announced they are ready and willing to bring their commercial versions of their craft, stimulated in large measure by the prospects of helicopter service in New York, New Jersey and passenger service in the Los Angeles area.

These read the disclosures:

■ **Sikorsky Aircraft** engineering manager Igor Sikorsky announced a commercial version of a 12-passenger military helicopter, in cost around \$125,000. Powered by a 600-hp. Wasp engine, the commercial model is scheduled to be flown by the first time this week.

■ **Pittsboro Helicopter Corp.** president Frank Pittsboro declared his company has developed a 16-passenger version of its HMP-2, designated the PD-17C. Price would be around \$190,000.

■ **Bell Aircraft** helicopter division manager David Harrison announced the Feeder-Liner, a 13-passenger commercial version of the military model 2042. The Feeder-Liner is designed to take either a 500-hp Pratt & Whitney R-1340 engine or an 800-hp Wright R-1090 engine.

■ **Key-Care** The three manufacturers hope to have an idea of who will buy—and how many, when the Civil Aeronautics Board completes its task on the New York area helicopter case. Although hearings are scheduled for Dec. 5 in Washington, participants

are trying to have the case heard in New York City after a 10-day extension.

The proposed helicopter service in New York, currently being sought by eight applicants, has been looking toward the Port of New York Authority, which has advanced to urge certification of helicopter service for the New York-New Jersey area. Leading contender for CAB approval is Air Commuting, Inc., New Rochelle Aviation Corp. and New York Airways, Inc.

■ **Applicants**—But while New York Air was claiming to have enough capital to serve 36 cities with approximately 10 flights, Air Commuting and Metropolitan Air Associates are reported to be merging their interests to present a strong bid.

New York Airways has submitted tentative route plans with its application, including arguments for help on 36 cities in New York, New Jersey and Connecticut. John L. Sennin, Jr., president of the firm, says the proposed routes for service to and from the three major fields in the area—La Guardia, New York International (Idle) and Newark. Scatter them across to these airports would operate as a central heliport in Manhattan, according to company executives.

■ **Efficient** Angle—Prompted by the prospective market for a large helicopter, the three manufacturers will first have to obtain valuable permission before they can begin production of commercial versions. And even then, the chances are slim that any of them can

stand the costly testing expense critics say, involve sizable costs for military models. To date, Pittsboro is the only one that has been able to quickly enter commercial production.

Bell Aircraft's craft, designed for a maximum range of 250 miles with full gross load, but not yet flown. Further development of the commercial craft will depend on large increases in a variable amount of vehicle weight.

Sikorsky's existing craft, several of which are on order, may be chosen by Los Angeles Airways if it receives permission to carry passengers.

Los Angeles Airways' bid would be tested by the Port Authority on its agreement for road service in New York.

The Port Authority fully states that ten-passenger craft will be available for commercial use in the mid of 1959. In addition it says, Sikorsky helicopters are now in the process of construction and it is "entirely probable that larger helicopters will enable commercially feasible passenger service."

Generally the industry is conducting survey flights to analyze the possibility of using Manhattan and tops of helicopters.

KLM Cites Gains

AMSTERDAM—KLM reports gross revenue for 1948 of \$7,667,410, as compared with \$7,487,680 for 1947. Operating costs were \$3,564,730 against \$2,440,979 for the previous year. Allowing for depreciation, a net profit margin of \$4,177,481 against \$5,146,710 for 1947. KLM's passenger traffic rose by 36 percent, that from goods traffic by 38 percent. Revenue in 1948 was adversely affected by having to reduce the Rotterdam route on Saturdays. The company in 1949 has three times had to apply for a government subsidy.

Based capital during 1948 was raised \$2,853,130, to \$15,951,170, half of which is owned by the government. In addition there is a government loan of \$9,775,110. The capital is considered sufficient, and negotiations are being carried on for placing new capital with the government.

The fleet now consists of 31 modern all-American aircraft: KLM does not intend to purchase construction of a four-engine, four-engine, seven-engine, fully unified with the American plane.

The number of personnel is now nearly 14,000.

The enormous growth of KLM is being reflected by the fact that in 1948 it was 132 percent of that for 1938. KLM hopes to meet increasing costs and competition by increased efficiency. Dr. Albert Pieneman, leader of the board of directors, declared that it is not KLM's intention to set its price in the near future.



GARDNER INDUSTRIES helps air freight, not as freight help the general industry. Here a window display of the B-24 bomber, a Lockheed, is shown in the window of Gardner's store in New York.

Air Freight Gets New Sales Punch

Forwarders broadening field of potential customers, but selling arguments differ from those of airlines.

In the midst of an air freight boom, the industry suddenly has discovered that separate arguments are equally powerful in selling the "ship by air" doctrine.

George T. Cannon, executive vice president of the Flying Tiger Line, one of the largest all-freight carriers, says, "The public usually will not pay a premium for speed."

Moore Shapira, president of Shipways Freight Forwarding Corp., a new entry in the growing freight forwarding field, says, "When we try to sell a customer as fast as the airplane or ship."

Brown-Cutler's line has been playing down speed in transit as a clincher for air freight usage. He says one big reason the recently-certificated carrier will show a profit is because its service is being proven as a money-saving proposition for shippers.

Shipways, which hopes to gain the small package business which up to now has always followed the cargo carrier, has a special reason for emphasizing speed.

The rate structure of that forwarder is significantly below air express and air freight rates for comparable weights. And the difference between Shipways' rate and current air express rates is so slight that the forwarder is

even the nation. This particular window display is scheduled to show, New York, Lockheed, Lockheed, Lockheed, Lockheed, and has appeared in the window of Gardner's store in New York.

actually in dollar cost competition with rail express. Except that Shipways, shipping by air, offers speed.

■ **Rate**—What the forwarder has done is to set freight rates beginning at one pound, based on the assumption of a volume business. In order to test, Shipways will have to handle about 4,000 in daily, but the first, which began operations Aug. 15, has a release record which already has more than 100 in the week of Oct. 17.

After a year, Shapira thinks Shipways will be able to do the air express and package plans. To substantiate this, he offers these comparable rate figures:

■ **N. Y. to San Francisco** For a five-pound parcel—air freight rate, \$5.25 (the maximum rate up to 25 lb.); air express, \$3.65; rail express, \$1.60; Shipways, \$2.40.

■ **N. Y. to Miami** For a 10-pound parcel—air freight rate, \$5.44 (the maximum rate up to 25 lb.); air express, \$3.75; rail express, \$1.60; Shipways, \$2.40.

■ **N. Y. to Minneapolis** For a 15-pound parcel—air freight rate, \$5.21 (the maximum rate up to 25 lb.); air express, \$4.45; rail express, \$3.02; Shipways, \$2.35.

Shipways, which was only scheduled to arrive and certified air freight service to arrive 21 hours, set its rates to include delivery from the New York terminal to three cities. Air and rail express are done to door.

■ **Another** Why—a more expedient service is offered by service including forwarder—Shipways Air Freight Corp. Shipways has built part of its reputation on "Blue Ribbon Service," which consists of pickup at one hour on short notice, direct transportation to the airport, handling ahead the first and fastest schedule of any airline, a schedule to destination clearing the flight delivery agent to meet the plane, direct delivery to consignee, and a telegram back to the shipper confirming the actual delivery time.

Obviously there can be no rate comparison between Shipways and Shipways. But again, the emphasis is put heavily on speed.

■ **Current Shipments**—Most of the business to flight forwarders and carriers on the East Coast comes from New York's general centers. Shipways estimates that about 90 percent of its business is with general merchandise. The Flying Tiger cannot benefit on general shipments on these two scheduled overnight flights daily.

Other commodities which are shipped on freight are still as varied as they can be immediately after the war.

George Datt, district sales manager for the Tigers, told Associated Press that the use of air freight is still spreading up although the low prices to attract its business from people al-



FEEDER-LINER

Wiggins Airways President Joseph Gaudin, right, received congratulations from Louis Thayer, owner, general sales in New York, David of Massachusetts, at the local news-gathered rights between Boston and Albany country. The short haul operates in using two-engine Cessna 441-20, one of which is shown in the background.



The Lockheed Constellation

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RE-ORDERED SO OFTEN!

The Lockheed Constellation is the world's most ordered four-engine transport. Most of the 14 major world airlines that have purchased Constellations have re-ordered this luxury airliner again and again, some as often as five times. Such repeat orders prove that Constellation customers are satisfied customers. "The proof of the pudding is in the eating!"

Most recent purchaser of Constellation is the Glendale & Southern Air Lines, which recently bought five Constellations. In 1950 alone, five major world airlines ordered a total of 45 new Constellations.

The dependable, profitable operation of Constellations over more than 5,000 million passenger miles, including nearly 20,000 Atlantic crossings, constitutes a tried and proven record that has created orders and re-orders. The constant world-wide demand has kept the Lockheed Constellation production line in continuous operation.

Look to Lockheed for Leadership—

Barbours, California



NEWEST MAINLINER

United Air Lines has received the first of seven Boeing Stearmaners and will put the 35-passenger craft in service between the West Coast and Hawaii in January. Boeing is available during limited delivery of the Mainliner "Hawaii" and J. A. Hirthle, Inc., U.S. war production supervisor, and W. M. Allen Boeing president.

ready sold as the "big by-air" dictator, rather than last the brakes to convert rail and road vehicles.

► **Outside Protection**—Getting air freight a full-time job for the all-ways carrier might have been a challenge for the airline, but because extra equipment for such services from an United Air craft Corp., which recently placed a full-page advertisement in several bus news magazines, saying:

"Air bag construction bearing your

Plush Service

National Airlines, a sign of the progress of modern airlines from and four-engine a-scale air coach, or tries to take a back seat on luxury services.

The company has reorganized a plush new four-hour nonstop DC-4 flight between New York and Miami at standard rates. Here's what the customer gets:

- Fifty-foot lengths of red loop-jack carpet with buff-rubber floor, sponge rubber backing will be rolled from the foot of the plane's loading steps to both arrivals and departures in New York and Miami.
- Territorial chrome-plated staircases and eight-foot lengths of chrome-plated chain will line the edge of the carpet.

General views placing the carpet and staircases have produced a major secondary drill as an extra touch.

- Most music will be played in background during loading. At Miami the music will be heard around a New York theme, with selections such as "Salsavita of New York" and "The Bower".
- At Idlewild Airport, the much-bused departure will have "Miami Over Miami."

- Lanes instead of paper airplanes will be used during meals, tropical beverages will be placed on north-bound flights out of Miami, and steamships will be a serving chart so the passengers can be addressed by name.



PHILADELPHIA TERMINAL GANGPLANK

In designing a \$6.5 million terminal in part of the terminal structure, the gang-plank would protect passengers from weather and gray days. The device would swing laterally and vertically and would advance or retract to reach the door of any transport

from LIABILITY



to RELIABILITY

National Aircraft Maintenance Corporation is fully equipped and qualified to change your aircraft from a liability to a shop-under-one-roof—NAMCO has assembled the most modern equipment and skilled personnel to perform any aircraft service.

You'll find our quality workmanship most economical—NAMCO eliminates costly delays—assures you of more flying hours—less hours lost by repair time.

Don't take chances... See NAMCO for fully dependable service!

OUR SHOP—ONE STOP



business? Here's one way to help keep your inventory down, your profits up.
"Base your buying on quality delivery by air."
Through plugs like this, the carriers are helped in their own air freight selling. Providers, however, have had to strap for customers, since few more facilities are aware of their services and prices.

AOA Head Visualizes 1955 Transport

Pentagon perspective in the design of a 1955 language transport to span broad passenger acceptance and become a money-maker for the carrier have been outlined by Harold R. Hanna, vice president and general manager of American Overseas Airlines.
Inspired by foreign projects in the jet transport field during his recent visit to the Society of British Aircraft Constructors exhibition, Hanna wanted U.S. engineers and manufacturers that they must "keep up with their design and construction." Unless the overall work is started at once, the desired airplane will not be feasible by 1955, the AOA official told the Society of Aeronautical Engineers at a recent meeting.

Propose Rules for Puerto Rico Agents

Proposed regulations which would tighten restrictions on airline travel agents were scheduled last week for public hearing in San Juan by the Puerto Rico Public Service Commission.

- If approved, the regulations would require all agents to secure a license from the PSC.
- Make it necessary for agents to return full fare when a passenger cancels 34 to 60 days before departure. In other cases the agent may keep 25 percent of the price of the ticket.
- Permit authorized passengers from boarding any aircraft.
- Make it mandatory that chartered aircraft carry no more than the authorized maximum number of passengers.

India Gives Nonsked Night Mail Contract

(McGraw-Hill World News)
BOMBAY—After every Indian scheduled airline refused to handle the government's proposal for carrying of mail at night between the country's four major cities—Bombay, Delhi, Calcutta and Madras—the contract was awarded to a private operator, Hindustan Airways Ltd. The carrier has three Douglas Douglas Dakotas.
The contract is expected by India

R.A.F. veterans of World War II. It has been based at Calcutta and flying to Southeast Asia ports. Currently it is a hastily purchased more recent to handle its new post-war air mail, in view of the many airline bankruptcy proceedings.

Meanwhile, the previous operator of the eight annual biweekly a limited response. Indian Overseas Airlines Ltd., is again flying Bombay-Nagpur-Calcutta along a long layoff brought on by failure of the line, which controls it. Although it has a license to Australia, and a reputation to fly the route, the project is on the shelf.

Navy Contract to TAL

Tombstone Air Lines, Burbank, Calif., has opened a four-engine charter plane service between its new operations base at Boeing Field, Seattle, and points in Alaska.
E. R. Sutton will manage the service, which will carry out a U.S. Navy contract to fly personnel and supplies between Seattle and Aleutian Island bases, and will also be available for commercial work. TAL for two years has had contracts to fly hundreds of fishermen to Alaska during the salmon season.



DC-3 RESTLED

Eastern Air Lines plans to give its prime DC-3s a "new look" within the next 12 months. Planned passenger seating steps and a large cargo door extending from the top of the rear cargo compartment to the floor are being studied to cut ground time at metropolitan ports. Modifications made the planes safe for moving the ladder to the right side. In the cabin's lower portion a baggage rack is being installed in the convenience of passengers, permitting to keep handy mail, overnight bags, food cases and small packages. Later installation is to be handled at EAL's Miami maintenance base will add 60 ft. to the DC-3's weight.

The Right Time



—TO SOLVE SHOCK AND VIBRATION PROBLEMS

Leading industrial manufacturers, seeking to meet production schedules and reduce costly delays, find it profitable to call in Robinson engineers NOW... when new products are contemplated and still in the planning stages. Only then can every important problem of vibration and shock control be anticipated in advance... and a solution planned.

Such a program will result in the protection of the manufacturer's equipment—effectively and economically. The VIBRASHOCK system then becomes an integral part of the unit or mechanism... confirmed with its construction to assure maximum performance.

MET-4-FLEX, the new all steel resilient cushion, exclusive with Robinson VIBRASHOCK systems, assures new high standards of performance, greater durability and exceptional tolerance to load and temperature variation.

Whether your vibration problems are known, or remain to be worked out... use the time-proven abilities and experience of the Robinson organization—a leader in the field.

Robinson VIBRASHOCK mounts, incorporating **MET-4-FLEX**, are available in standard mounting base sizes and as vast mounts. Special designs will be developed to meet unusual problems. Detailed literature and performance curves will be sent on request.



ROBINSON AVIATION, INC.

TETERBORO, NEW JERSEY

VIBRATION CONTROL EXPERTS

Pilots Blamed in PAA-Cessna Collision

Pilots of both planes were at fault in the collision last Jan. 30 at a Pitt Meadows Airport, British Columbia and a Cessna 140 over Port Washington, Long Island, N.Y.

This finding was made in an official Civil Aeronautics Board accident investigation report. Pilot and a passenger in the single-engine Cessna were killed and the aircraft destroyed. None of the 23 passengers or crew of 10 in the Cessna 441 was injured, but the transport-bound from LaGuardia Field

to Shannon, Ireland, was damaged substantially.

► **Possible Cause**—CAB said the probable cause of the accident was the joint failure of the Cessna 441 pilots to observe and avoid the Cessna, and at the same time, while in an emergency and in an area where heavy traffic was expected, to maintain proper altitude and avoid the Cessna 441.

The Cessna 441 and Cessna 140 collided at a 30-degree angle. The Cessna 441 was on the right, the Cessna 140 on the left. The Cessna 441 was behind the transport and was in the transport's blind spot. The Cessna 441 was in the transport's blind spot. The Cessna 441 was in the transport's blind spot.

either the pilot or copilot of the transport unless they had been forward as backward to the Cessna 441. CAB said the Cessna pilot should have been able to see the Cessna 441 without difficulty. The Board noted that the lightplane apparently was not being flown at a proper altitude in a controlled area.

When the planes collided, the Cessna's engine, propeller, landing gear and rear structure crumpled and scattered in the air. The Cessna 441 was in the air and the Cessna 140 was in the air. Although the Cessna was totally destroyed, the Cessna 441 sustained no damage and was in the air. The Cessna 441 was in the air. The Cessna 441 was in the air.

Mid-West Starts

Mid-West Airlines (formerly Louis Airplane Co.) has announced scheduled flight service between Omaha and Minneapolis/St. Paul via Des Moines and Cedar Rapids with single-engine Cessna 441s, Cessna 440s, S.D. and Omaha-North Platte, Neb., links are to be opened shortly.

SHORTLINES

► **Aeromexico**—Has received CAA authorization to use newly installed VHF omnidirectional radio stage facilities on the routes between Walnut Ridge, Ark., and Tulsa, Okla. (Aviation Week, Oct. 19). Company officials said AA is the first major U.S. carrier to use this kind of facility. The airline is taking advantage of the radio stage facility. All of Aeromexico's DC-8s and most of its 747s are equipped with the facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

► **Bozell**—Has transferred its northern regional office from Chicago City to Chicago, Illinois. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

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► **Cape Air**—Has been recommended by a CAB committee for a three year certificate to carry passengers, cargo and mail between Minneapolis and the Alaska coast. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

► **Eastern**—Is transferring five of its de-

ANCHOR BUSHINGS

insure template economy
in saving time accuracy

Anchor Bushings are available in a wide range of sizes and materials. They are used to drill holes in metal plates, pipes, and other materials. They are made of high quality steel and are designed to last for many years.

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CAB SCHEDULE

See 3rd and 4th pages of this publication for complete schedule. The schedule is subject to change without notice. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

passengers from New York and Washington to Miami.

► **KLM**—Has received CAA authorization to use newly installed VHF omnidirectional radio stage facilities on the routes between Amsterdam and New York, and Amsterdam and London.

► **McDonnell Douglas**—Has received CAA authorization to use newly installed VHF omnidirectional radio stage facilities on the routes between McDonnell Douglas and New York, and McDonnell Douglas and London.

► **New England Air Express**—The company's new aircraft has been ordered by CAB to show some of its latest aircraft. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

► **Northeast**—Has started work on a \$1,700,000 expansion project at Washington, D.C. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

► **Pan American**—Has received CAA authorization to use newly installed VHF omnidirectional radio stage facilities on the routes between Pan American and New York, and Pan American and London.

► **Southwest**—Has received CAA authorization to use newly installed VHF omnidirectional radio stage facilities on the routes between Southwest and New York, and Southwest and London.

► **TWA**—Has received CAA authorization to use newly installed VHF omnidirectional radio stage facilities on the routes between TWA and New York, and TWA and London.

► **Western**—Has received CAA authorization to use newly installed VHF omnidirectional radio stage facilities on the routes between Western and New York, and Western and London.

HELICOPTER PILOTS

United Helicopters, Inc. is seeking experienced helicopter pilots for its fleet of Sikorski HO4S and Bell 206 helicopters. The pilots will be based at our headquarters in New York City. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

POSITION VACANT

Aviation Week is seeking experienced pilots for its fleet of aircraft. The pilots will be based at our headquarters in New York City. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

SELLING OPPORTUNITIES OFFERED

Aviation Week is offering a variety of selling opportunities. The opportunities are available in a variety of industries. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

POSITIONS WANTED

Aviation Week is seeking experienced pilots for its fleet of aircraft. The pilots will be based at our headquarters in New York City. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

AVIATION WEEK

Aviation Week is a leading aviation publication. The publication is available in a variety of formats. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

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FOR SALE

Aviation Week is offering a variety of items for sale. The items are available in a variety of quantities. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

SOUTHERN CALIFORNIA REPRESENTATIVE

Aviation Week is seeking a representative for its fleet of aircraft. The representative will be based in Southern California. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility. The airline is taking advantage of the radio stage facility.

Castings of Wright quality now available...



Wright Aeronautical offers manufacturers complete factory facilities for producing Aluminum and Magnesium Castings

Wright Aeronautical now provides complete factory facilities to manufacturing firms in need of high quality aluminum and magnesium castings. This quality is assured because:

- (1) Our factory has specialized in the production of light weight, top quality castings for aircraft engines for 25 years.
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30

Keep Those Air Shows Safe

Thanks to the western editor of the "Boston Traveler," Robert Sibley, we have a first hand report of a safe and sane air show in Worcester. Yes, that is a happy contrast to the straggled-out exhibition that never will do justice to any goal.

Frank T. Fox, assistant of Worcester Municipal Airport, was surprised at the results. Writing Mr. Sibley—who agrees with AVIATION WEEK's editorial stand against dangerous racing—Mr. Fox says:

"The theme was strictly educational with none of the standard heart throb act. Everything went smoothly and without incident during the two-hour demonstration of the show. We received excellent cooperation from the Navy which insured the success of the event. The two-out was tremendous. More than a quarter of the city's population—some 60,000 people—turned out to watch. I had expected about 20,000. The spectators were enthusiastic and went away satisfied. I believe they gained a deeper insight into the significance of aviation."

Mr. Fox adds, "The winning attendance and the fine reaction of the spectators, I think, born out a contention we mutually subscribe to, that the main purpose of an air show is to enlighten—not frighten—the spectators. This show convinced me that the best air program should be arranged on the basis of keeping it safe and sane."

Mr. Fox's own candor would appear difficult to contest, but the defenders of air races in general continue to justify those spectacles.

Some races are more dangerous than others, of course. But we cannot justify air races. Because we think men measure the likelihood of accidents. We simply cannot see how anyone with the best interests of aviation at heart can tolerate any conditions that will increase accidents or result in greater loss of human life than is bound to occur in the course of necessary commercial and military operations.

Every other segment of aviation tries to avoid accidents like the plague. Why give races a reputation?

What do races accomplish, other than to enter to the thrill-seeker, or to those who seek publicity? Race defers on constantly going on generalities about the "technical benefits" of aviation races. Let them be specific, please. Exactly what technical benefits? Remember, this is 1949, the beginning of the aerospace era.

And suppose someone could master a few "technical benefits" of air races. How would they stack up in an otherwise against the history making accomplishments of

the three great laboratories of the NACA? Of Wright Field? Of the week-in and week-out static tests in our aircraft plants? Of the day-in, day-out flight-testing by the most skilled test pilots of our major aircraft and engine manufacturers, of the special tests and routine flights of hundreds of Air Force and Navy planes each week?

Anyone who has seen the pilots and specialists of the service, the laboratories and testing stations of government and industry at work with today's advanced, separately-accredited apparatus, can hardly be expected to consider the National Air Races—or any race—anything more than a food and nothing, memory in air technical value is concerned.

Another frequent argument for races is the one about "competition," and its spur to new ideas. We are for competition, too. But we think the "competition" among 10, 20 or even 50 miscellaneous pilots at an air race is worthless (these days a national welfare standpoint, or even from the standpoint of aviation if you consider the ever-present accident threat).

The "competition" at an air race is partly itself in one test to the competition of our leading aircraft companies for government orders, or with competition between those pilots, the U. S. Air Force and the Navy, for better ideas and faster planes. That is big-time competition that counts.

Let's face it. Air races are spectacles and sport. Nothing more, except when they bring the loss of human life. Then they are inhibition. And the danger threat is always there. Ask the insurance companies what air race sponsors want in loss coverage if you don't believe it.

Our critics say we antihuman are "unethical." The Olsen accident, they claim, was "distorted," and our attention to it was "disproportionate," or else we have "concentrated on sensationalism and scare headlines."

So we are not to get "emotional" about unnecessary loss of human life? Is it a "distortion" to point out that the Olsen accident toll could have been worse if the plane had gone into the stands, or through race boxes? Was our protest "disproportionate" because only three lives were lost instead of 30 or 100?

Indeed, the issue is much more far reaching than this single accident at Cleveland. That is why any amount of constructive criticism can hardly be "disproportionate" if it can save lives and help aviation.

—ROBERT H. WOOD



Why the Fighting "Parasite" has a canopy of "Lucite"®

MCDONNELL'S 6 REASONS FOR CHOOSING "LUCITE" WHEN DESIGNING BOMBER-BORNE XP-57

- "The McDonnell XP-57 is a new type 'parasite' aircraft... has made many successful flights operating from a modified B-29 mother plane. Here's why McDonnell and the designers, Standard Electric Co., of New Orleans, La., chose Du Pont "Lucite" acrylic resin for the canopy of this revolutionary plane.
- "Lucite" is crystal clear... tests produced to require government specifications for optical properties... optical undistorted vision.
- "Lucite" is strong and tough... tests through 27,000 p.s.i.—exceeds strength of 14,000 p.s.i.
- "Lucite" is lighter in weight... 60%

approximately one-half the weight of glass.

- "Lucite" protects pilot... a lightweight "Lucite" does not need reinforcing ribs.
- "Lucite" resists weathering... unaffected by sunlight, rain, and snow.
- "Lucite" is scratch resistant... is scored, drilled, bent, and forced into sharp compound curves without spalling.

Here you can see for a strong, transparent canopy? If so, remember the properties of "Lucite" that suggest look for further information on this and other Du Pont plastics.



Has your mind wandered like the North F-86? Here's why. It's equipped with control canopy "Lucite" that have been partially painted with black acrylic. These acrylic coatings are applied along the innermost shell from two and are designed so that the light before the pilot is visible when the canopy is "off" position, but hidden when the canopy is "on" position. The acrylic application of "Lucite" makes the pilot in an aircraft think the canopy of his fuel supply.



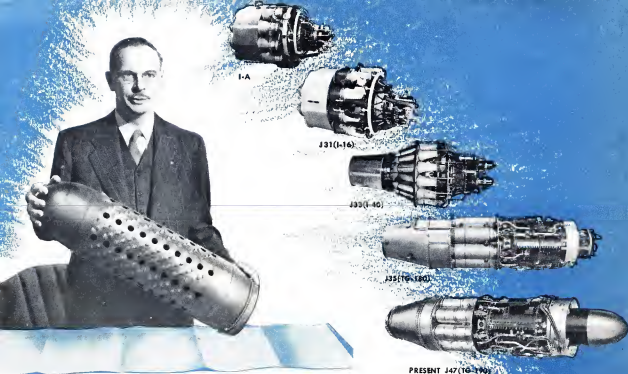
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CREATIVE POWER



The creative power of D. F. "Truly" Warner, designing engineer with General Electric's Aircraft Gas Turbine Divisions, sparked the design or development of five great G-E jet engines. With an impressive design background in steam turbines and turbosuperchargers, Warner pioneered aircraft gas turbine development in this country. His first work was based on the original Whittle engine.

He designed the I-A and I-16 engines which powered Bell's P-59—the first jet-propelled plane in the United States. He supervised the design of the I-40 engine—power source for Lockheed's F-80 "Shooting Star." In 1945 he took over further development of the J35 engine originally designed in Schenectady. Shortly after, he supervised design and development of the J47, one of the most powerful jet engines in production. The J47 furnishes power for North American's F-86 and B-45A, Boeing's B-47, Republic's XF-91, and supplements G-E turbosupercharged piston engine power in Convair's B-36.

Many G-E engineers such as "Truly" Warner are working today to provide new and better products for you and the aviation industry. Your nearest G-E representative will describe in detail the aviation products we engineer and manufacture. See him today. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL  ELECTRIC